

- II. "On the Partitions of the r -Pyramid, being the first class or r -gonous x -edra." By the Rev. T. P. KIRKMAN, M.A., F.R.S. Received October 14, 1857.

(Abstract.)

Partitions proper of the r -pyramid are made by drawing diagonals none crossing another in the r -gonal base, and diapedes (intersections of non-contiguous faces) none enclosing a space, in the r -edra vertex. The object of the memoir is to enumerate the number of such partitions that can be made with K diapedes in the vertex and k diagonals in the bases of the pyramid. By the drawing of k diagonals, the pyramid becomes a $(r+1)$ -acral $(r+k+1)$ -edron, which by the introduction of K diapedes becomes a $(r+K+1)$ -acral $(r+k+1)$ -edron. Such a figure is termed an r -gonous $(r+K+1)$ -acral $(r+k+1)$ -edron of the first class. The definition of an r -gonous x -edron of the first class is that it contains a *discrete r -gony*, i. e. K diapedes and k diagonals of which *no diaped meets a diagonal*, and such that the convanescence of the K diapedes will form an r -ace, and the evanescence of the diagonals forms an r -gon.

If the summits upon the k diagonals be, one or more of them, partitioned by K' diapedes, or the faces about the K diapedes be partitioned by k' diagonals, there arises a *mixed r -gony*, in which are one or more angles made by a diaped and a diagonal. If such a figure has not a discrete r -gony as well as that mixed one, and has no $(r+r')$ -gony, by the vanescence of which the $(r+r')$ -pyramid can be obtained, it is an r -gonous x -edron of the second class. And r -gonous x -edra of the third class can be obtained by partitioning the faces about the K' diapedes and the summits upon the k' diagonals, in such a manner that no $(r+r')$ -gony shall be introduced; and so on for higher classes of r -gonous x -edra.

It is proved that every partition proper of the r -pyramid, that is, any $(1+K)$ -partitioned r -ace laid on a $(1+k)$ -partitioned r -gon, is an r -gonous $(r+k+1)$ -acral $(r+k+1)$ -edron. The number of the $(1+k)$ -partitions of the r -gon, and of the $(1+K)$ -partitions of the r -ace is known by the formulæ given in the author's memoir "On the partitions of the r -gon and r -ace," in the Philosophical Transactions, 1857. The present memoir gives the formulæ whereby the

partitions of the pyramid are determined in terms of those of the r -gon and r -ace.

Thus the entire first class of r -gonous x -edra is enumerated, without descending to any classification of polyedra according to the rank of their faces and summits. The enumeration of the second and higher classes will require such classification, which will introduce so vast a complexity as to render the further prosecution of the theory of the polyedra, in the opinion of the author, practically impossible by any method deserving the name of scientific generality.

III. "Researches on the Cinchona Alkaloids." By W. BIRD HERAPATH, M.D. Lond., F.R.S.E. Communicated by Prof. STOKES, Sec. R.S. Received June 19, 1857.

(Abstract.)

PART I.—Critical examination of the ordinary methods employed for the discrimination of the Cinchona Alkaloids, viz. Quinine, Quinidin, and Quinicine and Cinchonine, Cinchonidin and Cinchonicine; together with the optical and chemical characters of their Iodo-Sulphates, upon which new methods are founded.

In consequence of the gradually increasing scarcity of the *cortex cinchonæ calysayæ* and its chief product quinine, many other barks have been introduced into commerce, which furnish alkaloids having a strong general resemblance in the physical characters of those preparations of them more commonly employed in medicine, but differing widely in medicinal properties and commercial values.

In order to prevent fraudulent adulterations, it has long been highly desirable to have some ready methods of detecting admixtures of these alkaloids and their salts. The author having discovered several optical salts of these vegetable alkaloids, proposes to make their well-marked optical characters the means of such detection, and in the second part of this paper has fully developed his views upon this ready method of analysis, whilst in the present part he has passed under review the various existing tests for the different cinchona alkaloids, and the results of his investigations may be enumerated under the following conclusions :—